

**MIRABILIS-FEEDING HELIODINES
(LEPIDOPTERA: HELIODINIDAE) IN CENTRAL ILLINOIS, WITH
DESCRIPTION OF A NEW SPECIES**

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Abstract.—We report finding in central Illinois an example of simultaneous, sympatric use of *Mirabilis nyctaginea* (Michx.) Sweet (Nyctaginaceae) by larvae of four species of Heliodinidae. The insects involved are *Heliodines tripunctella* Wlsm., *H. nyctaginella* Gibson, *H. ionis* Clarke, and an undescribed *Heliodines* species. We provide a description of the new moth and keys to adults of the four Illinois species.

Key Words: Heliodinidae, *Heliodines*, new species, Nyctaginaceae, *Mirabilis*

Members of the genus *Heliodines* are very small, primarily diurnal moths; most have golden-orange forewings adorned with raised patches of metallic lead-gray scales. The 22 described species are predominantly Nearctic or Neotropical, the exceptions being single European and Australian representatives. Larval host plants have been published for five species: *Heliodines roesella* (L.) on Chenopodiaceae (e.g. Stainton 1854, Emmet 1985); *Heliodines quinqueguttata* Walsingham (1897) on Portulacaceae; *Heliodines extraneella* Walsingham (1881) on Onagraceae (Braun 1925); and two species, *Heliodines nyctaginella* Gibson (1914) and *Heliodines ionis* Clarke (1952), on Nyctaginaceae.

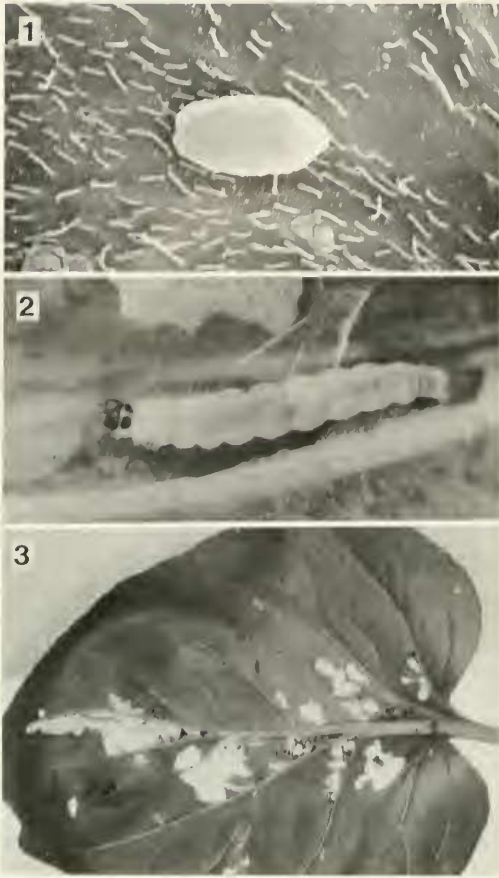
Heppner and Duckworth (1983) listed 11 North American species of *Heliodines* north of Mexico, and Hodges (1983) noted that the moths are seldom collected, probably because they are diurnal. A documented characteristic of heliodinid larval biology is the occurrence of more than one species in close proximity to each other (Wester 1956), sometimes with larvae feeding simultaneously on the same individual plant. We

report finding in central Illinois a striking example of sympatric, simultaneous use of *Mirabilis nyctaginea* (Michx.) Sweet (Nyctaginaceae) by four heliodinid species: *Heliodines tripunctella* Walsingham (1892), a leaf miner; *H. nyctaginella*, a flower feeder and upperside leaf skeletonizer; *H. ionis*, a stem borer; and an undescribed *Heliodines* species (underside leaf skeletonizer). As a preliminary step in our study of this insect-plant interaction, we provide a description of the new moth and keys for identifying adults of the four Illinois species.

Heliodines cliffordi

Harrison & Passoa, NEW SPECIES
(Figs. 1-3, 6-8, 12-13, 16)

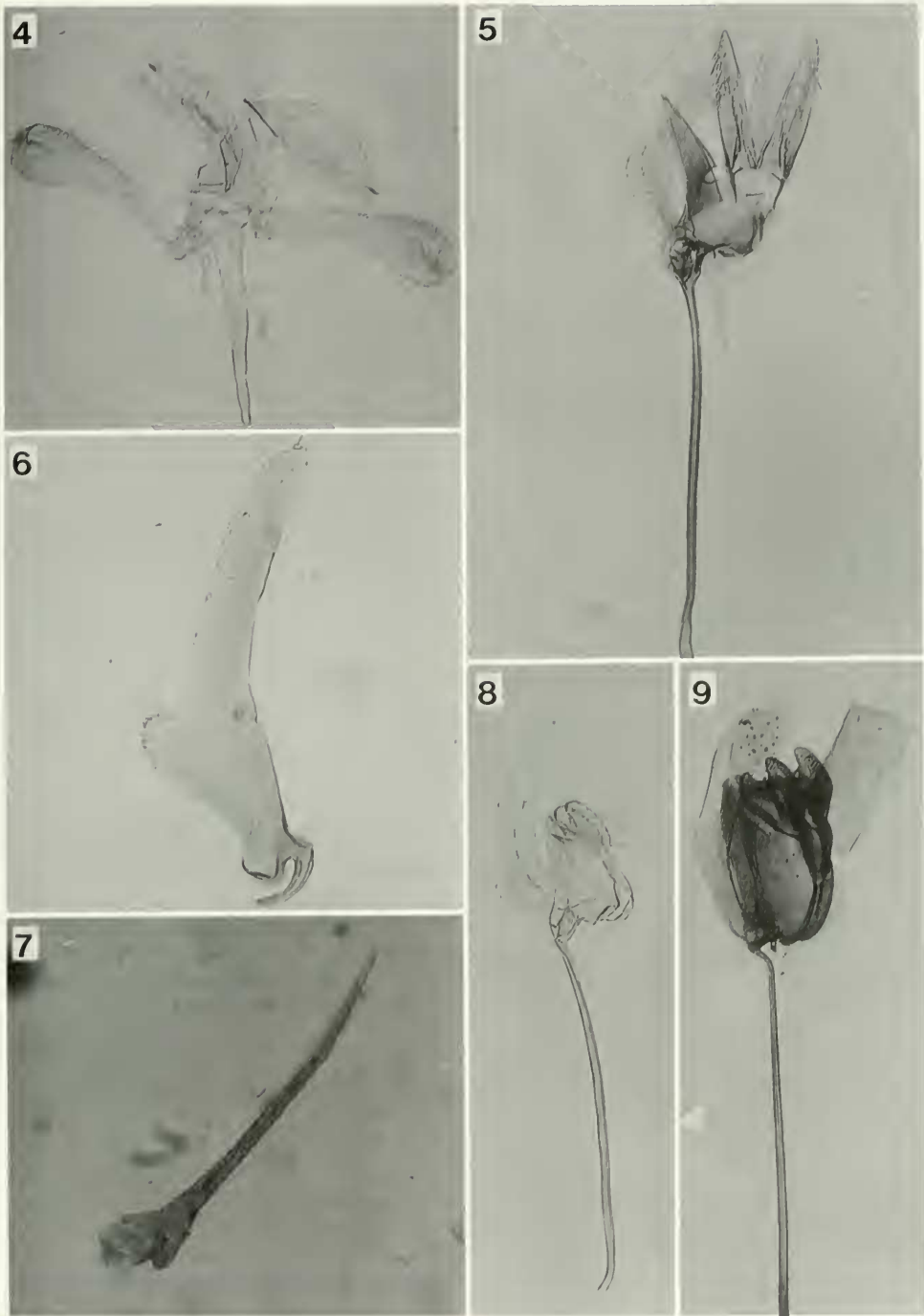
Ovum (Fig. 1): Whitish, somewhat flattened. Laid on the underside of a leaf. After hatching, the larva does not eat the remains of the egg. *Larva* (Fig. 2): On *Mirabilis nyctaginea* in Illinois; also known from *Mirabilis longiflora* L. in Arizona (our comments refer to Illinois specimens). One to several larvae on a single leaf, usually on the lower leaves of the plant. There are four larval instars. Upon hatching, the larva moves a



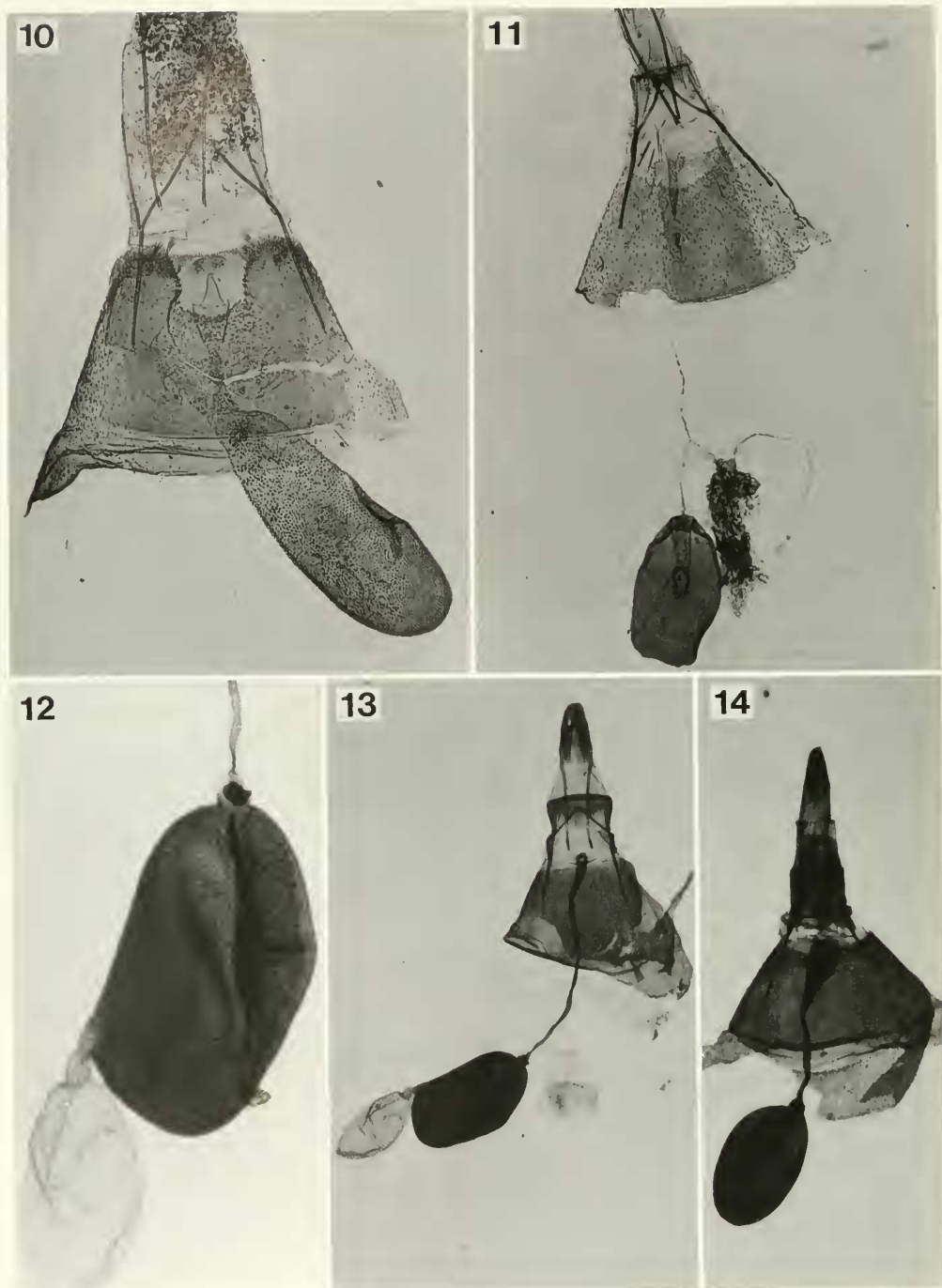
Figs. 1-3. *Heliodines cliffordi*. 1, Ovum. 2, Mature larva. 3, Larval damage to *Mirabilis nyctaginea*, with several larvae on underside of leaf.

small distance from the remains of its egg and burrows into the leaf. First two instars spent as a leaf miner, third and fourth instars as a leaf skeletonizer, feeding beneath a flat sheet of fine white silk on the underside of the leaf, eating all but the upper epidermis in an irregular blotch pattern (rarely, feeding on upperside of leaf). The "window" of damage (Fig. 3) is conspicuously visible on the upper surface of the leaf. Frass is deposited outside the feeding area and persistently adheres to the external surface of the silken sheet. General color of mature larva pale green, with no contrasting pinacula or other external markings; cuticle translucent, the aorta faintly visible as a dark dorsal

midline; head blackish brown throughout larval life; prothoracic shield concolorous with body during first three instars, blackish brown and divided longitudinally at the midline during fourth instar. A single SV seta on segment A9 in all instars. *Pupa*: Obtect; flattened dorsally, keeled laterally. No dorsal transverse rows of spines. No cocoon, pupation occurring among a slight, loose mass of silk from which the pupa is not protruded at eclosion. *Adult* (male and female): *Head*: Labial palpus: First and second segments dull yellow, the second slightly darker dorsally toward apex; third segment dull yellow suffused with light brownish gray. Antenna: Shining dark gray with violet reflections; apical five segments white. Face and head capsule: Smoothly scaled, shining gray; reflections brassy, greenish, or violet with differing angles of incident light; ocellus large and prominent; occipital scale band contrastingly dull yellow. *Thorax*: Shining gray as for head. Forewing: Length 4.5-5.0 mm. Ground color bright golden orange. Five costal, raised, metallic lead-gray spots, designated C1 (basal) to C5 (apical), at approximately 0.07, 0.19, 0.35, 0.50, and 0.67 (numbers represent respective average distances from wing base to centers of spots, expressed as percentages of total wing length, $n = 5$); spots C2 and C3 extend farther toward posterior margin of wing than do the other costal spots; C5 appearing triangular due to a shining-gray patch that narrows as it extends along costa from apical edge of the spot. Three dorsal, raised, metallic lead-gray spots, designated D1 (basal) to D3 (apical), at approximately 0.27, 0.44, and 0.60; D1 and D3 extend farther toward costal margin of wing than does D2. Anterior margin from wing base to spot C2, and posterior margin from wing base to D1, broadly margined with black; between these anterior and posterior areas, a discal, longitudinally oriented, yellowish-orange patch extends from near wing base to a point between C2 and D1, where it blends into the golden-orange



Figs. 4-9. Male genitalia. 4, *Heliodines tripunctella* (ventral aspect, spread and flattened, aedeagus removed). 5, *H. nyctaginella* (lateral aspect, aedeagus removed). 6, *H. cliffordi*, valve (lateral aspect). 7, *H. cliffordi*, aedeagus (lateral aspect). 8, *H. cliffordi* (lateral aspect, aedeagus removed). 9, *H. ionis* (lateral aspect, aedeagus removed).



Figs. 10-14. Female genitalia. 10, *Helioidines tripunctella* (ventral aspect). 11, *H. ionis* (ventral aspect). 12, *H. cliffordi*, detail of signum. 13, *H. cliffordi* (ventral aspect). 14, *H. nyctaginella* (ventral aspect).

ground; amount of black between spots C2 and C3 variable, always with at least a wide black anterior margin but in some specimens filled with black to the height of the two spots. Other spots margined with black to a varying degree, in most specimens at least finely so. Orange area extending farther apically on anterior margin than on posterior; costoapical extremity of orange area often with a small yellowish-orange patch. Wing distad of orange area very dark shining gray, with one small black patch in basal region of this area near costa and one from apical margin of spot D3. A discal, metallic lead-gray spot, rather small and only slightly raised, at approximately 0.77; the apical half of this spot lies in the outer gray area of the wing, the basal half interrupts the distal edge of the orange area. Fringe dark gray. All veins separate, including R_4 and R_5 . Hindwing: Length 4.0–4.5 mm. Lanceolate, very dark gray; fringe dark gray. R_s and M_1 separate, CuA_1 and CuA_2 present; remnants of two anal veins persistent. Legs: Foreleg with coxa shining gray, cream colored at apex; femur shining gray on outer surface from body, cream colored on inner; tibia shining gray laterally, cream colored medially; tarsus shining gray. Midleg colored as foreleg but tibia ringed with cream color at apex. Hindleg colored as midleg but apex of femur cream colored, and tibia with two dark-gray bands, one from tibial base to first pair of spurs, the other from two-thirds tibial length to edge of apical cream-colored band; spurs shining gray on outer surfaces from tibia, cream colored on inner; tibia smooth, not spined or otherwise modified. *Abdomen*: Shining gray, somewhat darker than thorax. *Genitalia*: As illustrated and described below in the key.

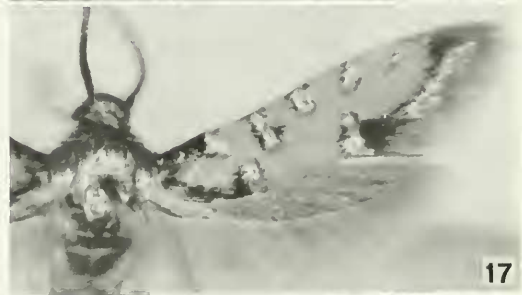
Volitinism: Probably four complete generations per year; mature larvae appear in central Illinois from late May to mid-June, again from mid- to late July, and at all times from early August through mid-September. Generations become asynchronous so that by August and afterward larvae of all instars



15



16



17



18

Figs. 15–18. Wings of adult moths. 15, *Helioidines tripunctella*. 16, *H. cliffordii*. 17, *H. nyctaginella*. 18, *H. ionis*.

can be found at once. Viable pupae from mature larvae collected 17 September 1993 had not produced adults by mid-November 1993; this suggests that the insect overwinters as a pupa.

Distribution: In addition to the type lo-

cality, Charleston, Coles County, Illinois, this species is represented by specimens from Putnam, Mason, and Champaign counties in Illinois [in the collection of the Illinois Natural History Survey, Champaign (INHS)]; and from the states of New Mexico (INHS), Iowa, Kansas [in the collection of the United States National Museum of Natural History, Washington, D.C. (USNM)], and Arizona (reared from *Mirabilis longiflora* by R. Wielgus; in the collection of D. Wagner, Storrs, Connecticut). Data for all Illinois specimens are entered into the Illinois State Lepidoptera Data Base, Springfield.

Holotype male: Collected as larva on *Mirabilis nyctaginea*, USA: Illinois, Coles County, Charleston, T12N, R9E, NW ¼ Sec. 11, 14-VI-1992, T. Harrison. Iss. 30-VI-1992 (USNM). *Allotype female*: Same data as for holotype except collected 8-VI-1990, iss. 22-VI-1990 (USNM). *Paratypes*: Deposited in the following collections: USNM; INHS; Illinois State Museum, Springfield; collection of S. Passoa, Reynoldsburg, Ohio; University of California, Berkeley; Cornell University, Ithaca, New York; American Museum of Natural History, New York, New York; Florida State Collection of Arthropods, Gainesville; Academy of Natural Sciences, Philadelphia, Pennsylvania; Canadian National Collection, Ottawa; The Natural History Museum, London, England.

Etymology: This species is named for the senior author's son, Clifford R. Harrison.

Discussion: *Heliodines cliffordi* is similar to *H. nyctaginea* and *H. ionis* but displays darker and more extensive gray and black scaling than do those two species. The wing venation is the same among the three. Genitalia differ as specified below in the key. In all three species, there is one SV seta on larval segment A9. There are four larval instars in *H. cliffordi*, in contrast to five instars in *H. nyctaginea* and non-overwintering *H. ionis*, and six instars in overwintering *H. ionis* (Wester 1956). *Heliodines*

tripunctella differs from *H. nyctaginea*, *H. ionis*, and *H. cliffordi* in that veins R₄ and R₅ in the forewing and Rs and M₁ in the hindwing are stalked; CuA₂ is absent in the hindwing; and there are two SV setae on larval segment A9. Other characters that distinguish *H. tripunctella* from the other three Illinois species are mentioned in the keys.

For field identification of mature larvae of the two leaf-skeletonizing species, *H. cliffordi* is pale green with a blackish-brown head and is found on the underside of the leaf, while *H. nyctaginea* is deep reddish brown with a tan head, and it skeletonizes the upper surface of the leaf. As for mature larvae of the other two Illinois species, *H. ionis* is yellowish white and is a stem borer; *H. tripunctella* is dull green with dark thoracic markings and is a leaf miner throughout larval life.

KEY TO ADULTS OF ILLINOIS
MIRABILIS-FEEDING *HELIODINES*,
BASED ON GENITALIA

- | | |
|---|---------------------|
| 1. Males | 2 |
| 1'. Females | 5 |
| 2. Each lobe of socius bifid; saccus and aedeagus relatively short, saccus less than three times as long as tegumen (Fig. 4) | <i>tripunctella</i> |
| 2'. Each lobe of socius single, not bifid; saccus and aedeagus relatively elongate, saccus greater than three times as long as tegumen | 3 |
| 3. Each lobe of socius at least five times as long as its maximum width, acuminate apically; tegumen small (Fig. 5) | <i>nyctaginea</i> |
| 3'. Each lobe of socius much less than five times as long as wide, bluntly rounded apically; tegumen large | 4 |
| 4. Valve composed of broad, triangular basal region and narrow, slightly curved apical region (Figs. 6, 8) | <i>cliffordi</i> |
| 4'. Valve rather uniformly narrow along entire length, expanding slightly in width from base to apex (Fig. 9) | <i>ionis</i> |
| 5. Ductus bursae much less than 20 times as long as wide, its junction with corpus bursae occurring posteriorly of anterior margin of segment A7; signum a uniformly sclerotized patch with one inwardly protruding spinelike process (Fig. 10) | <i>tripunctella</i> |
| 5'. Ductus bursae at least 20 times as long as its | |

- width at narrowest point, its junction with corpus bursae occurring well anterior of anterior margin of segment A7; signum not as above . . . 6
6. Signum divided into two sclerotized plates that lie on opposite surfaces of corpus bursae; ductus seminalis arising from ductus bursae, at a point posterior of corpus bursae (Fig. 11) . . . *ionis*
- 6'. Signum a single elongate-rhomboid plate lying lengthwise along side of corpus bursae (Fig. 12); ductus seminalis and ductus bursae originating very near each other, both from posterior end of corpus bursae . . . 7
7. Ductus bursae uniformly narrow from ostium to corpus bursae; a prominent accessory corpus bursae arising from near anterior end of corpus bursae (Fig. 13) . . . *cliffordi*
- 7'. Ductus bursae widened near ostium (Fig. 14); no accessory corpus bursae . . . *nyctaginella*

- (Fig. 17); occipital scale band shining gray, concolorous with head and thorax; antennae white tipped . . . *nyctaginella*
- 3'. Posterior margin of forewing not lined with black at base (Fig. 18); occipital scale band black, contrasting with head and thorax; antennae entirely dark . . . *ionis*

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KEY TO ADULTS OF ILLINOIS
MIRABILIS-FEEDING HELIODINES,
BASED ON EXTERNAL CHARACTERS

1. Dorsum of abdomen predominantly orange; at rest, living moth with metathoracic legs held elevated above body; forewing with a nearly uniformly wide, shining-gray border extending unbroken around wing margin from distal edge of spot C2 to a point slightly distad of spot D1; each forewing with three costal and one dorsal raised, lead-gray spots (Fig. 15) . . . *tripunctella*
- 1'. Dorsum of abdomen dark gray or black, not orange; metathoracic legs not held elevated; no continuous shining-gray border around margin of forewing; forewing always with more than four lead-gray spots . . . 2
2. Occipital scale band dull yellow, contrasting with shining-gray head and thorax; forewing with five costal, raised, lead-gray spots; distal margin of orange area of forewing interrupted by discal lead-gray spot; anterior margin of forewing from base to spot C2 and posterior margin from base to spot D1 broadly margined with black, the discal longitudinal patch between these black areas yellowish orange (Fig. 16) . . . *cliffordi*
- 2'. Occipital scale band concolorous with thorax or contrastingly black; six costal, lead-gray spots on forewing; no discal lead-gray spot, distal margin of orange area on forewing an unbroken curve; basal area of forewing narrowly or not at all margined with black; orange ground unicolorous, no contrastingly yellowish areas . . . 3
3. Posterior margin of forewing distinctly lined with black from base to basal edge of spot D1

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